

30 YEARS OF PROGRESS SESSION

Strategic Factors in the Development of the National Technology Transfer Network

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(NASA-TM-108594) STRATEGIC FACTORS
IN THE DEVELOPMENT OF THE NATIONAL
TECHNOLOGY TRANSFER NETWORK (NASA)
9 p

N93-18169

Unclas

G3/85 0146060



**THIRTIETH SPACE CONGRESS
COCOA BEACH, FLORIDA
APRIL 27 - 30, 1993**

STRATEGIC FACTORS IN THE DEVELOPMENT OF THE NATIONAL TECHNOLOGY TRANSFER NETWORK

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Leadership in technology is closely linked to leadership in commercial markets. Unless ideas can be pushed, pulled and cajoled from the laboratories to the marketplace and unless technological know-how meets the test of markets, America's jobs, standard of living and, ultimately, national security will be at risk. Our national technology policies must address this marketplace reality.¹

The Council on Competitiveness
*Gaining New Ground:
Technology Priorities for America's Future*

INTRODUCTION

Broad consensus among industry and government leaders has developed over the last decade on the importance of applying the U.S. leadership in research and development (R&D) to strengthen competitiveness in the global marketplace, and thus enhance national prosperity. This consensus has emerged against the backdrop of increasing economic competition, and the dramatic reduction of military threats to national security with the end of the Cold War.

A growing commitment to better harness the unparalleled potential of Federal R&D to enhance and support U.S. economic growth and industrial competitiveness has emerged in tandem with the on-going shift in national priorities. One indication of this commitment is NASA's initiative to establish the basis for a National Technology Transfer Network. This effort directly supports NASA's shared mission with all Federal R&D agencies to transfer Federally-funded technologies to commercial and industrial applications throughout the U.S. economy. Under NASA's leadership, six Regional Technology Transfer Centers (RTTC) and the National Technology Transfer Center (NTTC) currently operate as the core elements of an innovative national network to transfer Federal technology to the marketplace.

This paper will review the key factors and considerations that shaped--and continue to influence--the development of the RTTCs and the NTTC. Also, the future role of the national network in support of emerging technology policy initiatives will be explored.

THE CURRENT CHALLENGE

Since World War II, the U.S. has developed and maintained a Federal R&D base that exceeds that of all leading industrialized nations combined. This rich resource of technology, personnel, and facilities encompasses over 700 Federal R&D labs and facilities, and numerous R&D contractors and research universities throughout the Nation. Federal funding accounts for nearly one-half of the Nation's annual R&D expenditures, including yearly funding of over \$22 billion for Federal labs. Though primarily driven by basic research and national missions in areas such as defense, space, and health, Federal R&D has produced a valuable and extensive supply of technology that has current and potential applications across the private sector. Leadership in R&D in support of traditional public missions, however, is not enough by itself to meet the stiff economic competition faced by U.S. industry. Federal R&D and the resulting technologies must be coupled with the "ability to convert these technologies into manufactured products, processes and services that compete successfully in the marketplace."²

The effective transfer of technology to application in the marketplace requires a solid understanding of the current and emerging needs of industry. These needs represent the existing and potential demand for Federal technology. Indeed, a strong focus on the needs of the customer--industry--and flexibility in meeting those needs are essential elements of successful technology transfer. A recent study of State-supported technology assistance programs found that:

Programs should be market-driven. Successful programs are those that have taken an entrepreneurial approach and have a willingness to listen to customers and to change products and services to meet their needs. This requires developing a thorough knowledge and understanding of local industries, their markets and their clients³

This conclusion is supported by NASA's experience, which in the mid-1970's first began programs (such as focused technology application teams and centers) designed to address specific firm or industry-wide needs.

Regardless of whether "technology-push" or "technology-pull" strategies are employed, a strong customer orientation is critical to effectively meeting industry technology needs with Federal technologies. The absence of, and inability to coherently implement, such an orientation, however, has long hampered Federal efforts to understand and reach industry "markets" for Federal technologies.

The current challenge is to establish a comprehensive means of connecting the Federal technology supply with industry technology demand to create new market applications that strengthen U.S. industry. This goal is echoed by the Council of Competitiveness in its March 1991 report which states that:

The whole world has marveled at the technological superiority demonstrated by the U.S. military in the Persian Gulf. The challenge is to make equally good use of technology to help fight the recession at home and improve America's competitiveness in international markets.⁴

In recognition of this challenge, as well as other strategic factors, NASA has led the development of a market-oriented, national network that enables Federal and State programs to join together in addressing the technology needs of industry and moving Federal technology to the marketplace. The next section will outline the key elements of the national network, including the roles and relationships of the RTTCs and the NTTC and the strategic factors reflected in their development.

NATIONAL TECHNOLOGY TRANSFER NETWORK

In early 1991, NASA management began to develop the concept of a national network as a way to optimize its technology transfer efforts with U.S. industry through linkages and partnerships with complementary Federal and State-level programs. The formulation of the concept reflected three strategic developments:

- o The growing mobilization of Federal labs and agencies in support of technology transfer due to enabling legislation enacted throughout the 1980's;
- o The widespread development of State-level technology development and industrial extension programs since the early 1980's; and,
- o Increasing industry interest in utilizing Federal R&D and technology as a competitive resource.⁵

These three key developments were driven largely by the pressures of economic competition. More recently they have been fueled by the on-going downsizing of U.S. defense forces and the related R&D and industry. NASA management recognized that, as a result of these strategic factors, unprecedented opportunities existed for collaboration between Federal technology transfer programs and labs, State technical and business assistance programs, and industry. What was needed was an overall framework to enable the participation and leveraging of both Federal and State programs, and an operational network that could draw upon the Federal R&D and State-level resources to identify and serve the technology and related needs of industry.

NASA was uniquely positioned to implement the concept of a national network. First, in late 1989 Congress had charged NASA with lead-agency responsibility for establishing the National Technology Transfer Center (NTTC) as a national resource for Federal technology transfer. Second, NASA management decided in 1990 to replace its longstanding network of Industrial Applications Centers with six Regional Technology Transfer Centers that would be better positioned to work with Federal labs and State programs in serving industry. Third, NASA management could draw upon the "lessons learned" of NASA's nearly thirty years of technology transfer experience, including extensive collaboration with other Federal agencies and State programs. Thus, equipped with both motive and means, NASA proceeded to plan and implement the concurrent development of the NTTC and the RTTCs to form the core elements of a national network.

As a practical matter, NASA management also understood that the source of technology was largely unimportant to industry. Thus, it was established that the network would facilitate industry access to a broad range of Federally-funded R&D

resources, including NASA centers, other Federal labs, Federal R&D contractors, and research universities.

Overall, the national network is intended to provide a coherent structure for collaboration among Federal and State programs serving industry as well as a common reference point for firms seeking technology and assistance. Two key objectives emerged to guide the development of the network: (1) facilitate rapid access by U.S. private sector to Federal R&D and technology, and to the full range of technology transfer capabilities and services available throughout the United States; and, (2) foster cooperation and partnerships with Federal, State and local organizations and programs working to advance the technological competitiveness of U.S. firms and industry.

REGIONAL TECHNOLOGY TRANSFER CENTERS (RTTC)

The national network began in January 1992 with the start-up of RTTC operations in six regions spanning the United States. Regional deployment has allowed the centers to work closely with a wide range of Federal labs and State programs in serving the technology and related business needs of industry. Within each region, the RTTCs provide services to U.S. firms and industry groups, assisting clients to locate, assess, and acquire technologies from Federal labs within their region, and from throughout NASA and the Federal R&D base. The RTTCs seek to thoroughly understand the particular needs and conditions of each region's economy, industries and firms, and, hence, both the specific and aggregate demand for technology. In this way, they operate as regionally-focused, customer-driven catalysts for Federal technology transfer.

The RTTCs, on behalf of industrial clients, access the Federal technology supply through a variety of databases. In addition, the RTTCs have developed linkages and first-hand familiarity with Federal labs and other sources of Federally-funded technology, such as universities, within their regions. This allows the RTTCs to facilitate industry access to laboratory expertise and facilities, and to foster collaborative projects and activities between the labs and industry. The RTTCs' market orientation and knowledge of industry technology needs also enables them to assist Federal labs in marketing their technologies to industry.

The RTTC regions were purposefully aligned with those of the Federal Laboratory Consortium for Technology Transfer (FLC). The FLC, a pioneering organization established in 1974, serves as a regionally-organized coalition of over 500 Federal labs actively engaged in technology transfer. Partnerships are now in place and developing between each of the RTTCs and their FLC counterparts. Alliance with the FLC marks an important step towards the development of an integrated, national network that cross-cuts the Federal laboratory system.

To accomplish their mission, the RTTCs are developing partnerships with State-level programs and organizations throughout their regions. There are currently over 60 RTTC partners or affiliates at the State level including Small Business Development Centers, State economic development agencies, and State-sponsored technology extension and manufacturing assistance programs. Teaming with State-level agencies and industry assistance services has enabled the RTTCs to cost-effectively expand the reach of their services and scope of involvement with industry across each region.

NASA management of the RTTCs fully recognizes the importance of working with States to serve industry and coordinate efforts towards shared goals. This strategy acknowledges that while Federal and State agencies may have differing perspectives on the purpose of technology transfer (national competitiveness vs. local economic development), their respective goals and efforts converge at the local level. In short, "Global strength 'happens' on a local scale, with individual companies and industries, located in a particular State or region, improving their ability to compete in world markets."⁶ Thus, as the RTTCs enter their second year of operation, NASA is providing funds to further develop their regional networks of affiliated State-level programs, and build upon the industrial extension efforts of the States.

NATIONAL TECHNOLOGY TRANSFER CENTER (NTTC)

In late 1989, Congress directed NASA to initiate and establish the NTTC with the mission of enhancing U.S. competitiveness by facilitating the transfer of Federal technologies to the U.S. private sector. Given this broad charter, planning for the implementation of the Center focused on defining NTTC roles and functions that would address key barriers hampering Federal technology transfer efforts. Planning also included positioning the NTTC to selectively complement and augment existing and emerging technology transfer organizations and programs on both the Federal and State levels. NTTC planning resulted in the selection of four primary "niches" within which the NTTC is currently implementing core capabilities and services. They are:

- o Serve as the national gateway for Federal technology transfer, assisting U.S. firms and industry to locate the source(s) of Federal technology and technology transfer expertise most appropriate to their needs;
- o Foster U.S. private sector awareness of Federal technology transfer resources and opportunities through national outreach activities with trade and industry associations;
- o Provide training and education services to government and industry to develop the individual skills and organizational approaches critical to technology transfer; and
- o Stimulate and foster private/public technology commercialization partnerships with Federal labs, and assist in the development of Federal/State efforts supporting technology transfer and economic development.

In early 1991, NASA melded the NTTC planning into the national network concept, establishing the NTTC's role within the network as a "hub" resource operating at the national level. The NTTC then began to develop and implement capabilities, services, and initiatives within its core niches that cross-cut the national network and support Federal technology transfer efforts. For example, the NTTC gateway service, following initial pilot testing, began national operations in October 1992. This service relies upon the rapid searching of Federal technology databases to match industry technology needs with the most appropriate source(s) of Federal technology and assistance. The service, accessed through a national 1-800 number, acts as an initial point of entry for firms seeking solutions to problems or specific technologies to enhance their products and processes. It

results in referrals guiding the firm to a Federal lab or technology transfer resources, such as the RTTCs, that can directly address their specific interests. Within five months of the national opening of the gateway service, over 1100 industry inquiries were processed.

In another key area of the NTTC program, the NTTC launched a national initiative, known as the Fund for Strategic Partnerships, in November 1992. Under this initiative, the NTTC will co-fund competitively selected projects that demonstrate innovative approaches to commercializing Federal laboratory technology. The initiative, which has generated widespread interest, is intended to stimulate technology partnerships involving Federal labs, industry, and State/local economic development organizations.

To ensure that its efforts remain properly focused, the NTTC has established three advisory boards: (1) a Federal Agency Board with representatives from 16 agencies, (2) an Industry Advisory Board with representatives from firms and corporations across the U.S., and (3) a Technology Managers Advisory Board with representatives from Federal labs, the RTTCs, and State-level industrial extension programs. These advisory boards provide counsel and inputs from viewpoints critical to technology transfer: the Federal technology supply, the industry technology demand, and the technology transfer and industry assistance infrastructure.

The NTTC is currently developing partnerships and cooperative efforts with a number of key Federal agencies that complement RTTC linkages with Federal labs and State programs. For example, the NTTC is implementing an agreement with the Commerce Department's National Technical Information Service to improve the quality of information on Federal laboratory R&D programs and assets, and expand its availability to industry. The NTTC has also established close ties with the FLC at the national level that parallel the FLC/RTTC regional-level partnerships.

Overall, NASA, as the architect of the network, first sought to integrate the combined efforts of the NTTC and the RTTCs within a common operating philosophy and to establish the basis for flexible, innovative teaming involving Federal agencies and labs and State-level industrial extension programs. The achievement of this objective, while not yet optimized, is reflected in the synergistic roles, relationships, and services developed by the centers. A second objective, which will be addressed briefly in the next section, involves the further development of the network.

EMERGING POLICIES AND THE ROLE OF THE NETWORK

As highlighted earlier, efforts by both government and industry to better leverage Federal R&D and the resulting technologies to bolster U.S. competitiveness and economic growth have achieved increasing acceptance and success over the last decade. It now appears that the Clinton administration, with support from Congress, will build upon this momentum and act to further align Federal R&D with the needs of industry.

The administration's plans, as outlined in the Clinton technology policy issued in September 1992, emphasizes: "Leadership in developing and commercializing new technologies is critical to regaining industrial leadership, creating high-wage

jobs, and ensuring our long-term prosperity."⁷ To accomplish this goal, the policy outlines a series of initiatives, two of which the national network could directly support.

First, the policy calls for increased commitment to leveraging the current Federal R&D investment through technology transfer and collaboration between Federal labs, research universities and industry. The national network, building upon its activities in this area, is well positioned to serve as an established means of brokering technology transfer partnerships with industry and increasing the flow of Federal technology to the private sector.

Second, the Clinton plan proposes the creation of 170 manufacturing extension centers to assist small and medium-sized businesses to adopt proven and leading manufacturing technology and practices. This initiative would build upon the current State-level industrial extension programs, included the manufacturing technology centers established by the Commerce Department's National Institute of Standards and Technology and its State partners. Many of these efforts are currently allied with the national network as part of a teaming strategy to best serve the full spectrum of industry needs and technology interests. Thus, the network, with its industry orientation and emphasis on commercializing Federal technology, could perform an integral role in expanding Federal/State efforts to assist in the technological advancement and modernization of U.S. manufacturers.

CONCLUSION

The national network is uniquely structured to provide a flexible, market-oriented means for coordinating and focusing the implementation of Federal and State technology transfer and industrial extension programs as well as other aspects of the emerging technology policy. By design, the RTTCs and the NTTC are establishing Federal/State partnerships in support of the mutual goals of U.S. industrial competitiveness and economic growth. The need for a common framework to enable such collaboration has been well established. For example, the Government-University-Industry Research Roundtable has emphasized that:

*The focus must be on cooperation to establish shared goals and to achieve a full partnership to mobilize the combined institutional and scientific/technical expertise of the U.S. R&D system. In cooperative efforts, there must be an agreed-upon structure for coordination that is neither solely 'top-down' nor 'grass roots' -- a joint undertaking for achieving both local and national goals for strengthening the U.S. competitive position and scientific endeavors."*⁸

The RTTCs are becoming a leading means for developing and implementing Federal/State collaboration on a regional basis. In turn, the NTTC, as the hub of the network, is becoming established as a national focal point for fostering government-industry cooperation and addressing common challenges hampering the technology transfer efforts of Federal agencies. Overall, the NTTC and the RTTCs serve as the core elements of an evolving network that provides a national framework for the public and private sectors to work together to realize the economic potential of Federal R&D and advance U.S. economic growth and competitiveness.

ENDNOTES

1. Council on Competitiveness, *Gaining New Ground: Technology Priorities for America's Future*, March 1991, p. i.
2. Ibid. p. 2.
3. Marianne K. Clarke and Eric N. Dobson, *Increasing the Competitiveness of America's Manufacturers: A Review of State Industrial Extension Programs*, Center for Policy Research, National Governor's Association, Washington, D.C., 1991, p. 19.
4. Council on Competitiveness, *Gaining New Ground: Technology Priorities for America's Future*, March 1991, p. i.
5. Clarke and Dobson, p. vii, and Government-University-Industry Research Roundtable, *Federal-State Cooperation in Science and Technology Programs: A Discussion Paper by the Federal-State Dialogue on Science and Technology*, National Academy Press, Washington, DC, February 1992, p. 3.
6. Government-University-Industry Research Roundtable, p. 3.
7. Clinton/Gore, National Campaign Headquarters, *Technology: The Engine of Economic Growth*, Little Rock, Arkansas, September 11, 1992, p. 1.
8. Government-University-Industry Research Roundtable, p. 12.

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